

new mesenteries are disposed at either the one or the other extremity, not at both.

4. Six new bilateral pairs of mesenteries appear practically simultaneously in *Madrepora*, but only later do they all extend down the polypal wall. In *Porites* the new pairs follow one another in a regular succession.

5. In *Madrepora* the mesenterial increase is early associated with fission of the stomodæum and in the end probably with complete polypal fission, in which half the mesenteries of each fission polyp are derived from the primary twelve of the original polyp and the other half are new formations. The resulting paired arrangement of the mesenteries, including the presence of two pairs of directives, is exactly as in primary polyps. Fission of the stomodæum appears very late in *Porites*, not until after the full establishment of six new pairs of mesenteries.

(References in No. 155, Jan. 1902; see 'Annals' for May 1902.)

## XV.—A Revision of the Fishes of the Family Stromateidæ.

By C. TATE REGAN, B.A.

SINCE the revision of this family by Gill \* in 1884, when he considerably enlarged its limits as understood by Günther †, no additions have been made to our knowledge of its affinities. The character which has always been taken as diagnostic of this family is the presence of teeth in the œsophagus, and Günther grouped the fishes which possessed this character into two genera, *Stromateus* and *Centrolophus*; to these Gill added the genus *Schedophilus*, placed by Günther in the Coryphænidæ, the genus *Palinurichthys* (*Pammelas*, Gthr.), placed by Günther in the Carangidæ, and the species *Psenes anomalus* (*Trachynotus anomalus*, Schleg.). Gill subdivided the family thus constituted as follows:—

### Subfamily CENTROLOPHINÆ,

with complex elongate gill-rakers extending backwards from the epi-branchials of the last gill-arch, 11 abdominal and 14 caudal vertebrae, protractile premaxillaries, and normal persistent ventral fins.

- Genus 1. *Centrolophus*; body elongate, dorsal spines slender.  
 2. *Schedophilus*; body ovate, dorsal with 4 short stout spines.  
 3. *Lirus*; body ovate, dorsal with 6 to 8 short stout spines.

\* Gill, Proc. Am. Phil. Soc. xxi. p. 664 (1884).

† Günther, 'Study of Fishes,' p. 452 (1880).

## Subfamily STROMATEINÆ,

with sacciform processes extending back from the last branchial arch, 14-15 abdominal and 17-21 caudal vertebræ, non-protractile premaxillaries, ventral fins rarely persistent.

Genus 1. *Stromateus*; with ample branchial apertures.

Subgenus *a. Stromateus*, no pelvic spine.

„ *b. Peprilus*, a trenchant pelvic spine.

„ *c. Poronotus*, a trenchant pelvic spine and a row of vertical slits above the lateral line.

„ *d. Apolectus*, the lateral line keeled posteriorly.

Genus 2. *Stromateoides*, with restricted branchial apertures.

Subgenus *a. Stromateoides*, dorsal and anal spines trenchant.

„ *b. Chondroplites*, dorsal and anal spines concealed, subcartilaginous.

Genus 3. *Psenopsis*, with persistent perfect ventrals.

In 1896 Steindachner\* proposed to unite this last genus (type *Psenes anomalus*, Schleg.) with his genus *Paropsettus* (type *Paropsettus panamensis*), which he had previously considered as allied to *Psettus*, but now placed in the Stromateidæ. I have examined *Paropsettus panamensis*, and it appears by no means closely allied to *Psenopsis*, although superficially it bears a great resemblance to *Stromateoides*. Dr. Steindachner has been misled by the presence in the œsophagus of numerous conical papillæ, which have a similar appearance to the toothed processes of *Stromateus*, but are soft and fleshy, and not confined to the sides of the œsophagus. Similar papillæ are present in *Platax*, *Ephippus*, and *Chatodipterus*, which, together with *Paropsettus*, constitute the family Ephippidæ, as defined by Messrs. Jordan and Evermann. *Psettus* is not closely related to *Paropsettus*, and belongs to the Scorpidae.

Messrs. Goode and Bean ('Oceanic Ichthyology,' p. 215) unite the genera *Icosteus* and *Ichthys* with the Stromateidæ. The affinities of these rare fishes are obscure, but *Icosteus*, which I have examined, certainly does not possess teeth in the œsophagus.

Gill, in 1893 (Nat. Ac. Sci. vi., Mem. 5, p. 115), made a list of the fishes of New Zealand, in which the Stromateidæ are represented by a single species, *Neptotichthys violaceus*, Hutton. Hutton † places this fish in the Carangidæ, and no reason is given by Gill for his alteration. On investigation I find it to be a *Scorpiis*, closely allied to *Scorpiis chilensis*, Guich.

In the course of attempting to find definite characters by which the so-called Scombriform fishes could be diagnosed, I have discovered that the Stromateidæ must be enlarged by the addition of the following genera:—*Nomeus*, *Cubiceps*,

\* Steindachner, Ann. Hofmus. Wien, xi. p. 211 (1896)

† Trans. N. Z. Lst. v. p. 261, pls. viii. & xxii. p. 278.

*Psenes*, *Bathyseriola*, and *Seriotelella*, all of which have a toothed œsophagus exactly similar to that of a *Centrolophus*.

The genus *Apolectus* (*Stromateus niger*, Bl.), on the other hand, must be removed from this family, as it lacks œsophageal teeth, and should be placed in the Carangidæ. It can only be separated from those species of *Caranx* with a reduced spinous dorsal and feeble dentition by the disappearance of the ventrals in the adult fish. The pectoral is long and falcate and the lateral line keeled and shielded posteriorly, exactly as in *Caranx*. The ventrals are not jugular, and the young possess two free anal spines and three or four short dorsal spines, which become overgrown with age.

The Stromateidæ may be thus defined:—

No bony stay for the præopercle. Pectoral pterygials regularly hourglass-shaped, the first in contact with the coracoid. Scapula with a median foramen. Second suborbital usually with an internal subocular lamina. Entopterygoid present. Palatine arch attached to preethmoid and preethmoid cornua. A greater or less number of sessile ribs anteriorly, posterior ribs inserted on the transverse processes where these unite to form a closed hæmal arch. Transverse processes directed downwards, epipleural bones variously attached. Two nostrils on each side. Gill-membranes free from the isthmus (except in *Stromateoides*). Pseudobranchiæ present, often rudimentary. Five to seven branchiostegals. Gills four, a slit behind the fourth. Œsophagus with lateral sacs, which are toothed internally. Lower pharyngeals not united. Dorsal fin long, with a more or less distinct spinous portion. Anal with 3 or more spines, long, sometimes as long as the soft dorsal. Ventrals, when present, below or somewhat behind the pectorals, 1 5, attached to the abdomen by membrane, depressible in a more or less well-marked groove or furrow. Pelvic bones attached, but not firmly united, to the pectoral arch.

The skeleton is never strongly ossified. The opercular bones are thin, the operculum ending in two flat points, the other opercular bones denticulated or entire. Mouth small or moderate, jaws generally weak, with a trenchant edge, having a single series of small, slender, pointed teeth. Palate and tongue rarely toothed. The shape of the body varies from elongate to deeply ovate. The nostrils are usually nearer the end of the snout than the orbit.

The scales are small or of moderate size, extending on to the vertical fins, generally thin, deciduous, and cycloid. When not deciduous the scales are often pierced by small pores; usually the naked body is covered by pores, which are often minute, sometimes conspicuous. The skull has well-devel-

loped muciferous channels and cavities, and during growth the muciferous system seems to extend from the head over the body as a superficial network of canals, this extension being accompanied by the falling off of the scales or else the scales being pierced by pores.

The lateral line is continuous, its scales with a short, straight, and wide tube.

In all the genera it appears that the liver is small, the intestine long, the pyloric appendages in small number, but usually each with numerous small cæca, forming an arborescent mass; sometimes the pyloric appendages are large and simple, and Riggio \* has recorded an instance of a specimen of *Centrolophus niger*, in which species this is usually the condition, which had the pyloric appendages excessively branched. This is a good example of that kind of variation which Bateson considers of much importance in the origin of species, and also shows that the character of the pyloric appendages is of no great value in defining genera. The air-bladder is either present or absent.

Most of the fishes of this family are known chiefly from young specimens, which swim freely near the surface in the open ocean, feeding on pelagic Crustacea and the fry of other fish. Larger specimens have been rarely taken at considerable depths, and there seems fair ground for the conclusion that the adult fishes are in many cases inhabitants of the deep sea.

The differences in the vertebral column are best presented in tabular form, and the figures in the various columns represent:—A, total number of vertebræ; B, præcaudal vertebræ; C, præcaudal vertebræ without ribs; D, præcaudal vertebræ without transverse processes, with sessile ribs; E, præcaudal vertebræ with transverse processes and sessile ribs; F, præcaudal vertebræ with ribs on transverse processes; and G, præcaudal vertebræ with closed hæmal arch. H, præcaudal vertebræ with epipleurals on neural arch; K, on ribs; L, on transverse processes; and M, on vertebræ. N, caudal vertebræ.

	A.	B.	C.	D.	E.	F.	G.	H.	K.	L.	M.	N.
<i>Stromateus fiatola</i> ....	46	23	2	7	0	14	14	2	0	0	21	23
<i>Nomeus Gronovii</i> .....	41	16	2	2	5	7	7	2	4	0	10	25
<i>Stromateoides cinereus</i> ..	36	15	2	3	0	10	10	2	0	0	13	21
<i>Cubiceps gracilis</i> .....	33	15	2	7	0	6	6	2	0	0	13	18
<i>Psenes cyanophrys</i> ....	31	13	2	(4)	(2)	5	5	..	..	..	..	18
<i>Peprilus triacanthus</i> ..	31	14	..	..	..	..	..	..	..	..	..	17
<i>Seriolaella porosa</i> .....	24	10	2	1	5	2	2	2	4	2	2	14
<i>Lirus ovalis</i> .....	25	10	2	2	5	1	1	2	7	1	0	15
<i>Psenopsis anomalous</i> ....	24	10	2	3	1	4	4	..	..	..	..	14

\* Riggio, Naturalista Sicil., Ann. xiii. p. 206 (1894).

It will be seen that there are great differences between the genera, but in all cases the following generalizations apply. A greater or less number of the anterior præcaudals have no transverse processes, and are followed by vertebræ with downwardly directed transverse processes, successively increasing in length, and in the posterior præcaudal region uniting ventrally to form a closed hæmal arch. The two first præcaudals have no ribs and are followed by vertebræ with sessile ribs, which are inserted lower down on each succeeding one, becoming attached ventrally to the hæmal arch when the transverse processes unite.

Throughout this family considerable changes take place during growth, and the non-recognition of this fact has been the cause of multiplication of nominal species. In some genera, e. g. *Nomeus*, *Cubiceps*, the shape of the body changes from short and deep in the young to elongate in the adult; but this does not occur throughout the family. The vertical fins always undergo considerable changes, in most cases being relatively of much greater height in the young, and often during growth they become much more densely scaly, and some of the spines are overgrown and imbedded. The ventral fins are always much longer in the young; the pectorals, on the contrary, are subsymmetrical and rounded in the young, and during growth, owing to the greater elongation of the rays of the upper half of the fin, become asymmetrical and relatively of greater length. Thus the length of the ventrals and pectorals or the height of the dorsal and anal are of little value for systematic purposes, unless the size of the specimen described is given.

Another cause of the multiplication of species on the part of some systematists has been their ignorance of the fact that certain characters regarded as specific are really common to all the species of a genus. Thus, in all the forms with deciduous scales, grooves or furrows, corresponding to the intermuscular septa, are seen on the body; and these have given rise to the specific names of *sulcatus*, *bilineatus*, &c. Also the presence or absence of pores on the body has been taken as a character by which to distinguish between species, their supposed absence being in many cases due to the fact that they cannot easily be detected in all preserved specimens. Generally the first two or three articulated rays of the dorsal are unbranched, and so have been reckoned as spines by some authors.

The genera of this family have in not a few instances been insufficiently diagnosed, and the addition of several which

have not hitherto been understood to belong to it suggests the need of a complete revision.

The family as now defined includes the Nomeidæ of Günther, minus the genus *Gastrochisma*; the latter resembles *Nomeus* only in its long ventral fins, depressible into a deep furrow. But as in all the Scombridæ and Carangidæ, as well as the Stromateidæ, the ventrals are inserted close together, more or less widely attached to the abdomen by membrane, and folding back close together into a more or less well-marked groove or hollow, the extreme development of this feature cannot by itself be taken as evidence of genetic affinity.

In all other characters *Gastrochisma* is a typical member of the Scombridæ and must be placed in that family. The single species, *Gastrochisma melampus*, closely resembles in appearance *Lepidothynnus Huttonii*, Gthr.\*; and as the correspondence extends to the number of scales, fin-rays, and vertebræ, I have not the least doubt that the latter is only a large example of the former species. The smaller size of the ventrals in the larger fish is paralleled in the genera *Nomeus*, *Psenes*, *Lirus*, &c. As in other Scombridæ, the ribs are inserted at the ventral ends of the hæmapophyses, and it is not impossible that the skeleton of *Lepidothynnus*, described from a photograph, may have been incorrectly set up, as it shows the ribs inserted near the bases of the hæmapophyses. In its compressed body and short gill-rakers *Gastrochisma* resembles *Cybium*, with which it also agrees in the structure of the dorsal fin and the number of vertebræ, whilst the high occipital crest is similar to that of *Coryphæna*.

It has been generally supposed that the teeth in the œsophagus are borne by gill-rakers of the last branchial arch, and throughout the family there are short processes which may be of this nature; but, in addition, the anterior part of the œsophagus has on each side a large muscular sac, which is studded with numerous separate conical or papilliform processes bearing setiform teeth similar to those which occur on the gill-rakers and pharyngeals. In *Stromateus*, *Peprilus*, and *Stromateoides* these lateral sacs are simple and rather clongate; in the other genera they are much shorter and broken up by longitudinal folds into several compartments on each side.

#### *Synopsis of the Genera.*

- I. Ventral fins present in the adult; œsophagus with longitudinal plications.
  - A. Lateral line concurrent with dorsal profile.

\* Günther, 'Challenger' Pelagic Fishes, p. 15, pl. vi.

- a.* Spinous dorsal with 10–11 slender spines,  
at least as high as the soft dorsal.
- Teeth on vomer and palatines . . . . . 1. *Nomeus*.  
Teeth on vomer and tongue at least in the young;  
body oblong; ventrals behind pectorals . . . . . 2. *Cubiceps*.  
Palate toothless; body ovate; ventrals below pectorals. 3. *Psenes*.
- b.* Dorsal spines short.
- Maxillary with small supplemental bone . . . . . 4. *Seriotelella*.  
Maxillary without supplemental bone . . . . . 5. *Psenopsis*.  
B. Lateral line curved anteriorly, becoming  
straight before reaching the caudal peduncle.
- Body elongate . . . . . 6. *Centrolophus*.  
Body ovate . . . . . 7. *Lirus*.
- II. Ventral fins absent in the adult; cesophagus  
without longitudinal plications.
- A. Gill-membranes not joined to the isthmus.
- Pelvis not projecting as a spine . . . . . 8. *Stromateus*.  
Pelvis projecting as a spine . . . . . 9. *Peprilus*.  
B. Gill-membranes broadly joined to the isthmus. 10. *Stromateoides*.

In the following descriptions I have marked \* species which are not represented in the British Museum collection. The descriptions of those not so marked are based on specimens in the British Museum collection. I have marked † synonyms which I have been unable to verify.

NOMEUS.

Cuv. Règn. Anim. Ed. i, ii. p. 315 (1817).

Body oblong, moderately compressed, covered with cycloid scales of moderate size. Head scaly except the snout; mouth small; premaxillaries feebly protractile; maxillaries entirely concealed when the mouth is shut, without supplemental bone; teeth on vomer and palatines; opercular bones thin, entire; 6 branchiostegals; gill-rakers of moderate length; pseudobranchiæ well developed; gill-membranes not united, free from the isthmus. Spinous dorsal with 10 or 11 slender spines, the middle spines longest and as long as the longest soft rays, continued on to the soft dorsal, which is long and has the anterior rays highest. Anal with 3 spines, similar to the soft dorsal. Pectorals long, with 23 rays. Ventrals well developed, attached to the abdomen by membrane and depressible in a deep furrow. Caudal forked. Lateral line running high, concurrent with the dorsal profile. Air-bladder present. 41 vertebrae.

This genus apparently consists of one species only, *Nomeus Gronovii*, Cuv. Cuvier and Valenciennes mention a second species, characterized by white ventrals with two dark transverse bands, which they call *N. Peronii*; and this may possibly be identical with *Psenes maculatus*, Lütken, or with *Psenes arofurensis*, Gthr., both of which possess this character.

*Nomeus Gronovii*, Gmelin.

Full synonymy given by Jordan and Evermann, Fish. N. Am. i. p. 949.

In this species the changes which take place during growth are similar to those which occur in *Cubiceps gracilis*, the body being much deeper in the young, which have shorter and subsymmetrical pectorals and longer ventrals. The ventral fins are inserted distinctly anteriorly to the pectorals in very young specimens, below them in older fish.

D. X-XI, I 25-27. A. III 25-27. Sc. 64-66  $\frac{4.5}{20-21}$ . Gill-rakers of moderate length, about 18 on the lower part of the anterior arch.

The changes during growth can be best represented in tabular form, the numbers in the various columns representing in millimetres:—A, total length without caudal; B, depth of body; C, length of head; D, length of snout; E, eye diameter; F, interorbital width; G, length of pectoral; H, length of ventrals.

A.	B.	C.	D.	E.	F.	G.	H.
118	30	31	8	8	10	36	27
90	23	23	6	6	8	28	23
70	19	20	5	5.6	6.5	20	20
56	17	17	2.5	5	4.5	15	17
37	11	12	1.6	4.5	3.8	9	13
19	7	7	.8	3	1.8	5	7.5

The scales are deciduous, the body being covered with numerous very small mucous pores.

## CUBICEPS.

*Cubiceps*, Lowe, Proc. Zool. Soc. 1843, p. 82.

*Atimostoma*, Smith, Ill. Zool. S. Afr., Fish, pl. xxiv. (1845).

*Navarchus*, Filippi & Verany, Mem. Acc. Sci. Tor. (2) xviii. 1860, p. 7.

*Trachelocirrus*, Doumet, Rev. et Mag. Zool. 1863, pl. xv.

This genus is closely allied to *Nomeus*, but differs in having shorter ventrals, which are inserted posteriorly to the pectorals, broad coracoids which form a long symphysis causing the thorax to appear cultrate, and a patch of teeth on the vomer and on the tongue at least in the young, whilst palatine teeth are absent. 33 vertebræ. Caudal deeply forked.

*Synopsis of the Species.*

a. D. XI, I 20-22; A. III 19-20.

Depth of body equal to length of head,  $3\frac{1}{2}$  times

in total length. Sc. 66  $\frac{6}{22}$ ..... 1. *C. capensis*.

Depth of body  $4-4\frac{1}{2}$  times in total length.

Sc. 58-66  $\frac{4}{16-19}$ ..... 2. *C. gracilis*.



b. D. X-XI, I 14-17; A. III 14-15.

Pectorals longer than the head ..... 3. *C. pauciradiatus*.  
 Pectorals much shorter than the head ..... 4. *C. brevimanus*.

### *Cubiceps capensis*.

*Atimostoma capense*, Smith, l. c.

This species is known only from one specimen, 4.3 inches long, which is now stuffed and in the British Museum collection. It seems to me probably distinct from *C. gracilis* by the deeper body and greater number of scales in a vertical series.

Depth of body equal to the length of head,  $3\frac{2}{5}$  times in the total length. Snout as long as the eye, the diameter of which is about 4 times in the length of head. Maxillary not extending to below the eye. Caudal peduncle  $1\frac{2}{3}$  times as long as deep. D. XI, I 20, the spines increasing in length to the third or fourth, thence decreasing, the soft fin low, the anterior rays produced. A. III 20. Pectorals  $1\frac{1}{3}$  times as long as the head. Ventrals rather short. Caudal forked, the lobes rather short. Scales  $66\frac{6}{23}$ , still adherent in places and with irregular edges, the naked parts of the body with large mucous pores. Yellowish brown above, light purplish brown beneath; fins reddish brown.

Cape of Good Hope.

### *Cubiceps gracilis*.

*Seriola (Cubiceps) gracilis*, Lowe, l. c.

*Navarchus sulcatus*, Filippi & Verany, l. c.

*Trachelocirrus mediterraneus*, Doumet, l. c.

Depth of body 4-4 $\frac{1}{2}$  times in total length ( $3\frac{1}{2}$  in very young), length of head  $3\frac{1}{4}$ - $3\frac{1}{2}$  times. Snout shorter than the eye, the diameter of which is  $3\frac{1}{2}$ -4 times in the length of head and equal to the interorbital width. Maxillary extending to vertical from anterior margin of eye. D. XI, I 20-22, the fourth and fifth spines longest; anterior soft rays longest, not as long as longest spines. A. III 19-20. Pectorals  $1\frac{1}{5}$  times as long as the head, ventrals less than half as long. Sc. 58-66  $\frac{4}{16-19}$ , deciduous, numerous minute pores on the naked body. Back and sides brownish purple, light red in the very young, silvery below.

Total length 170 millim.

Mediterranean, Madeira.

### *Cubiceps pauciradiatus*.

Günther, Ann. & Mag. Nat. Hist. (4) x. 1872, p. 423.

Depth of body  $4\frac{1}{4}$  times in total length, length of head  $3\frac{1}{2}$

times. Snout shorter than eye, the diameter of which is 3 times in the length of head and equal to interorbital width. Maxillary extending to below anterior margin of eye. D. XI, I 17. A. III 14, beginning below the seventh soft ray of the dorsal. Pectorals  $1\frac{1}{3}$  times as long as the head, more than twice as long as the ventrals. Sc. 48  $\frac{2\frac{1}{2}}{12}$ . Purplish brown, fins lighter.

One specimen, 120 millim. in total length, from Misol, Moluccas.

\* *Cubiceps brevimanus*.

Klunzinger, Fisch. Roth. Meer. p. 116, pl. xii. (1884).

Depth of body about  $4\frac{1}{2}$  times in total length, length of head about  $4\frac{2}{3}$  times. Snout as long as eye, the diameter of which is 4 times in the length of head. D. X, I 14-15, the first spine  $\frac{1}{3}$  the length of the second, which is the longest and equal to  $\frac{2}{3}$  the depth of body; soft dorsal low,  $\frac{1}{4}$  the depth of body. A. III 15, beginning below the third or fourth ray of the soft dorsal. Pectorals  $\frac{4}{5}$  the length of head. Sc. 50  $\frac{2\frac{1}{2}}{13}$ . Back dark, sides silvery, fins grey, caudal and pectorals white.

One specimen, 800 millim. in total length, from deep water in the Red Sea.

PSENES.

Cuv. & Val. ix. p. 259 (1833).

This genus is distinguished from *Cubiceps* by the shape of the body, which is ovate and strongly compressed, by the absence of teeth on the tongue and vomer in the young, by the ventrals inserted below the pectorals, and by the coracoids, which are not dilated and do not form an elongated symphysis; so that the thorax does not appear cultrate in this genus. Vertebrae 31.

*Synopsis of the Species.*

- |   |                            |
|---|----------------------------|
| D. XI, I 33-34; A. III 34. Body deep and semi-transparent .....   | 1. <i>P. pellucidus</i> .  |
| D. X, I 25-27; A. III 25-27. Sc. 52-56 $\frac{4-5}{22-26}$ .<br>Depth of body about twice in total length . . . | 2. <i>P. cyanophrys</i> .  |
| D. XI, I 22-23; A. III 23. Depth $2\frac{1}{2}$ to 3 times in total length .....                                | 3. <i>P. maculatus</i> .   |
| D. XI, I 22; A. III 22. Sc. 47 $\frac{3}{20}$ . Depth about $1\frac{2}{3}$ times in total length .....          | 4. <i>P. arafurensis</i> . |
| D. XI, I 19; A. III 19. L. lat. 55 .....  | 5. <i>P. Whiteleggii</i> . |

- D. X-XI, I 15; A. III 15. L. lat. 41-43. Scales very deciduous; silvery, purplish above . . . . . 6. *P. indicus*.  
 D. X, I 15; A. III 15. Silvery, spotted and mottled with blue . . . . . 7. *P. regulus*.

\**Psenes pellucidus*.

*Psenes pellucidus*, Lütken, Spolia Atlantica, p. 516, fig. 601 (1880).

Depth of body  $2\frac{1}{3}$  times in total length, length of head 4 times. Snout shorter than the eye, the diameter of which is  $2\frac{2}{3}$  times in the total length. D. XI, I 34; A. III 34; vertical fins high; pectorals  $\frac{2}{3}$  the length of head; ventrals as long as the head. Colourless and semitransparent.

Atlantic.

*Psenes cyanophrys*.

*Psenes cyanophrys*, Cuv. & Val. ix. p. 260 (1833).

*Psenes javanicus*, Cuv. & Val. t. c. p. 264.

*Psenes auratus*, Cuv. & Val. t. c. p. 264.

*Psenes leucurus*, Cuv. & Val. t. c. p. 265.

*Psenes guamensis*, Cuv. & Val. t. c. p. 266.

*Psenes fuscus*, Guichen. Mém. Soc. Sci. Nat. Cherbourg, 1836, p. 133.

*Cubiceps multiradiatus*, Günther, Proc. Zool. Soc. 1871, p. 661, pl. lxi.

Depth of body  $1\frac{1}{3}$  to  $2\frac{1}{3}$  times in total length, length of head  $3\frac{1}{4}$  to  $3\frac{1}{2}$  times. Snout as long as the eye, the diameter of which is  $3\frac{1}{4}$  to  $3\frac{1}{2}$  times in the length of head, interorbital width  $2\frac{2}{3}$  times. Maxillary extending to below anterior margin of eye or a little beyond. D. X, I 25-27. A. III 25-27, the spines increasing in length to the third or fourth, which is the longest, and longer than the highest soft rays. Soft dorsal and anal slightly emarginate, the anterior rays longest. Pectorals longer and ventrals shorter in larger specimens, the former as long as the head and the latter  $\frac{1}{3}$  of that length in the largest specimen. Sc. 52-56  $\frac{4-5}{22-26}$ .

Brownish, with dark parallel lines of dots along the rows of scales. Dorsal, anal, and ventral fins dark brown. Pectorals white. Very young with irregular vertical bands.

Total length 125 millim.

Atlantic and Indo-Pacific.

\**Psenes maculatus*.

*Psenes maculatus*, Lütken, Spolia Atlantica, p. 110 (1880).

Depth of body about 3 times in total length ( $2\frac{1}{2}$  in very young specimens), length of head 3 to  $3\frac{2}{3}$  times. Snout shorter than the eye, the diameter of which is  $2\frac{1}{4}$  to 3 times in the length of head. D. XI, I 22 or 23; A. III 23. L. lat. 51.

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Yellowish, with 6 or 7 grey-brown vertical bands, which extend on to the dorsal and anal. Spinous dorsal black, soft dorsal and anal with a black marginal line; ventrals black at the base and at the free end, clear in the middle. Pectorals white.

Atlantic.

*Psenes arafurensis.*

*Psenes arafurensis*, Günther, 'Challenger' Pelagic Fishes, p. 13, pl. ii. (1888).

Günther was mistaken in describing this species as having only 7 spines in the spinous dorsal. In his type specimen some of the dorsal spines are broken off short, but it is easy to count 11 dorsal spines, as in other species of *Psenes*. The single specimen known resembles *P. maculatus* in colour, but is distinguished by its deeper body, as is shown by the following measurements:—Total length, without caudal, 30 millim.; depth of body 18 millim.; length of head 12 millim., of snout 2 millim.; eye-diameter 4.5 millim. D. XI, I 22. A. III 22. Sc. 47  $\frac{3}{20}$ .

Arafura Sea.

\**Psenes Whiteleggii.*

*Psenes Whiteleggii*, Waite, Proc. Linn. Soc. N. S. Wales, (2) ix. 1894, p. 218, pl. xvii.

Depth of body  $2\frac{1}{2}$  times in total length, length of head  $2\frac{3}{4}$  to  $2\frac{2}{3}$  times. Snout half as long as the eye-diameter, which is 3 times in the length of head and more than the interorbital width. Maxillary extending to below anterior margin of eye. D. XI, I 19, the third and fourth spines longest, equal to half the length of head, higher than the soft dorsal. A. III 18. Pectorals long,  $\frac{5}{6}$  the length of head. Ventrals reach the anal. Caudal deeply forked. L. lat. 55.

Delicate salmon-colour, crossed by three brownish transverse bands, the first very broad, extending from the head to the vent, the second narrower, connecting the middle rays of the soft dorsal and anal, the third on the caudal peduncle.

Head brown above, silvery below; fins brown.

Total length 47 millim.

Coast of New South Wales.

*Psenes indicus.*

*Cubiceps indicus*, Day, Proc. Zool. Soc. 1870, p. 690.

*Psenes indicus*, Day, Fishes of India, p. 237, pl. liv. fig. 2 (1878).

Depth of body  $2\frac{1}{4}$  times in total length, length of head 3

times. Snout  $\frac{1}{3}$  to  $\frac{1}{2}$  as long as the diameter of the eye, which is  $2\frac{1}{2}$  to 3 times in the length of head and equal to the interorbital width. Maxillary extending to below the anterior margin of the eye. D X-XI, I 14-15, the fourth and fifth spines longest, equal to half the length of head; anterior soft rays longest, equal to the eye-diameter. A. III 15. Pectorals  $\frac{4}{5}$  the length of head. Scales very deciduous. L. lat. 41-43. Silvery, purplish above; spinous dorsal dark.

Total length 100 millim.

Coast of Madras.

\**Psenes regulus*.

*Psenes regulus*, Poey, Repert. ii. p. 375 (1868).

Body compressed, regularly oval; mouth small. D. XI 15, the fourth, fifth, and sixth spines the highest. A. III 15. Caudal moderately forked. Scales small, rounded, concentrically striated. Silvery, with blue spots on the sides about as large as the eye; a band passing through the eye.

Total length 90 millim.

Coasts of Cuba.

This species is evidently distinct from *P. indicus*, differing markedly in having adherent scales and in the coloration, and probably in other characters not supplied by Poey's incomplete description, and is entirely different from *Cubiceps pauciradiatus*, which Jordan and Evermann consider to be identical with it.

SERIOLELLA.

*Seriolella*, Guichen. in Gay, Fauna Chilena, Pisces, p. 238 (1847).

*Neptomenus*, Günther, Cat. ii. p. 390 (1860), and Proc. Zool. Soc. 1869, p. 249.

Body oblong or ovate, compressed; mouth moderate; premaxillaries scarcely protractile; maxillary with small supplemental bone, slipping for the entire length of its upper edge under the præorbital; branchiostegals five to seven; gill-membranes united far forward, free from the isthmus; gill-rakers long; pseudobranchiæ reduced and fleshy in the adult; no teeth on the palate; opercular bones thin, with minute denticulations or entire. Scales small, deciduous. Upper surface of head with a spongy porous integument. Lateral line running high, concurrent with dorsal profile. Dorsal fins confluent, with VIII 27-40 rays, the spines short. Anal with III 19-24 rays. Pectorals with 21-22 rays. Caudal forked or emarginate. Vertebrae 24.

In some species pyloric caeca branched, forming an arborescent mass, in others a few simple pyloric caeca.

*Synopsis of the Species* \*.

- A. D. VIII 38-40; conspicuous pores on the body.  
 Depth of body  $4-4\frac{1}{2}$  times in total length ..... 1. *S. porosa*.  
 Depth of body  $3\frac{2}{3}-3\frac{3}{4}$  times in total length ..... 2. *S. bilineata*.  
 B. D. VIII 27-31.  
 a. Depth of body  $2\frac{2}{3}-2\frac{3}{4}$  times in total length ..... 3. *S. brama*.  
 b. Depth of body about 3 times in total length.  
 Snout as long as the eye, which is of moderate size. 4. *S. violacea*.  
 Snout shorter than the eye, which is large ..... 5. *S. Valenci*.

*Seriolella porosa*.

*Seriolella porosa*, Guichen. *l. c.* p. 239, lam. 7.

*Neptomenus dobula*, Günther, Proc. Zool. Soc. 1869, p. 429.

Depth of body 4 to  $4\frac{1}{2}$  times in total length, length of head  $3\frac{1}{2}$  to 4 times. Snout longer than the eye, the diameter of which is 4 to 5 times in the length of head, interorbital width about  $3\frac{1}{4}$  times. Maxillary extending to below the anterior margin of the eye. D. VII, I 37-40, the third, fourth, and fifth spines longest, about equal to half the diameter of the eye; the anterior soft rays about  $\frac{2}{3}$  the length of head. A. III 23-24. Pectorals nearly as long as the head, ventrals half as long. Caudal widely forked. Gill-rakers nearly as long as gill-fringes, about 14 on the lower part of anterior arch. Back and sides bluish grey, silvery below; fins and upper surface of head reddish brown or yellowish brown.

Total length 480 millim.

Coasts of Australia and New Zealand, Pacific coasts of South America, Atlantic coast of Patagonia.

*Seriolella bilineata*.

*Neptomenus bilineatus*, Hutton, Tr. N. Z. Inst. v. 1872, p. 261.

Depth of body equal to length of head,  $3\frac{2}{3}$  to  $3\frac{3}{4}$  times in total length. Snout much longer than the eye, the diameter of which is  $5\frac{1}{3}$  to 6 times in the length of head, interorbital width  $3\frac{1}{4}$  times. Maxillary scarcely reaching the vertical from the anterior margin of the eye. D. VII, I 38, the fourth spine longest, about  $\frac{2}{3}$  the diameter of the eye. A. III 24. Pectorals not as long as the head, twice as long as the ventrals. Caudal forked. Gill-rakers about  $\frac{2}{3}$  the length of gill-fringes, about 12 on the lower part of the anterior arch.

\* *Seriolella caerulea*, Guichen. *l. c.*, is insufficiently described, but does not appear to belong to this genus, and may be a *Lirus*. The body is short, ovate, the depth 3 times in the total length with caudal. Scales very small. Dorsal with 10 stout spines. Pectorals pointed, longer than ventrals. Caudal forked. Deep blue above, lighter below.

Back and sides pale violet, silvery below; tip of both dorsals and inner surface of pectorals blackish.

Total length 170 millim.

, New Zealand.

*Seriolella brama.*

*Neptomenus brama*, Günther, Cat. ii. p. 390 (1860).

*Neptomenus travale*, Casteln. Proc. Zool. Soc. Vict. i. 1872, p. 119.

Depth of body  $2\frac{3}{4}$  to  $2\frac{3}{4}$  times in total length, length of head  $3\frac{1}{2}$  to  $3\frac{3}{4}$  times. Snout as long as or longer than the eye, the diameter of which is  $3\frac{3}{4}$  to  $5\frac{3}{4}$  times in the length of head, interorbital width about 3 times. Maxillary extending to below anterior margin of eye. D. VIII 27-31, the spines increasing in length to the fourth and fifth, which are the longest and about equal in length to  $\frac{2}{3}$  the eye-diameter in the young; the soft fin emarginate, the anterior rays as long as the postorbital part of the head, the posterior rays half as long in the young, less than  $\frac{1}{3}$  as long in the adult. A. III 21-23. Pectorals elongate, falciform,  $1\frac{1}{2}$  times as long as the head, twice as long as the ventrals in the young, 3 times in the adult. Ventrals inserted behind the pectorals, more markedly so in the adult. Caudal deeply forked. Sc. 87-100  $\frac{11-14}{25-32}$ , deciduous, the naked body with conspicuous pores in the largest specimen only. Lateral line forming a keel on the caudal peduncle. Blue-grey, with a copper tinge on the sides. Upper part of head a brown copper-colour. A broad dark purple vertical band from in front of the dorsal to the point of the operculum. Fins yellowish, inner side of pectorals blackish, ventrals rosy white.

Total length 400 millim.

Coasts of Australia and New Zealand.

*Seriolella violacea.*

*Seriolella violacea*, Guichen. l. c. p. 241, lam. 7.

Depth of body equal to length of head, 3 times in total length. Snout as long as eye, the diameter of which is  $3\frac{2}{5}$  times in the length of head, interorbital width  $3\frac{1}{2}$  times. Maxillary extending to below anterior third of eye, not entirely slipping under the præorbital. Præ-, sub-, and interopercles minutely denticulated. D. VIII 27, the second spine 3 times as long as the first, the rest subequal, the last rather longer than the rest, the soft rays much longer than the spines, the soft fin highest anteriorly. A. III 19, similar to soft dorsal. Pectorals? Ventrals inserted below the

pectorals. Caudal emarginate. Sc. 87  $\frac{12}{28}$ . Lateral line following dorsal profile at  $\frac{3}{4}$  the height of the body. Gleaming violet above, silvery below.

Total length 85 millim.

Coast of Chili.

*\*Seriocella Velaini.*

*Seriocella Velaini*, Sauvage, Arch. Zool. Exp. viii. 1879, p. 32.

Depth of body  $3\frac{1}{2}$  times in total length with caudal (? about 3 times in total length without caudal), length of head  $4\frac{1}{2}$  times (?  $3\frac{3}{4}$  times without caudal). Snout shorter than the eye, the diameter of which is  $3\frac{1}{2}$  times in the length of head, and less than the interorbital width. Maxillary extending to below the anterior margin of eye. D. VIII 27, spines subequal, short, equal in length to half the diameter of the eye; the soft fin low, the first rays sometimes a little higher than the others. A. III 20, emarginate, the anterior rays twice as long as the last. Pectorals falciform, as long as the head. Ventrals less than half the length of the pectorals and inserted below them. Caudal deeply emarginate. Sc. 90. Lateral line following dorsal profile. Colour?

Total length 690 millim.

Island of St. Paul.

PSENOPSIS.

*Psenopsis*, Gill, Proc. Ac. Philad. 1862, p. 157.

*Bathyseriola*, Alcock, Ann. & Mag. Nat. Hist. (6) vi. 1890, p. 202.

Body ovate, compressed, snout truncate; mouth small, no teeth on the palate. Premaxillaries feebly protractile, maxillaries without supplemental bone, entirely slipping under the præorbital. Opercular bones thin, entire or minutely denticulated, branchiostegals seven; gill-membranes united far forward, free from the isthmus; pseudobranchiæ glandular; gill-rakers rather long; scales of moderate size, very deciduous; lateral line concurrent with the dorsal profile. A single dorsal fin, with VI-IX 26-30 rays. Anal with III 22-26 rays. Pectorals pointed, with 22 rays. Ventrals below or slightly in front of the pectorals. Vertebrae 24.

Pyloric cæca arborescent. Air-bladder absent.

*Synopsis of the Species.*

Depth of body  $2\frac{1}{4}$  times in total length ..... 1. *P. anomala*.  
 Depth of body  $3\frac{1}{4}$  times in total length ..... 2. *P. cyanea*.

There can be no question that these two species belong to the same genus, although their relationship has not hitherto been suspected. The dark mucosa which Alcock described as lining the gill-chamber in *P. cyanea* is also to be seen in



*P. anomala*, and the two species are very closely allied, the chief difference between them being the much deeper body of *P. anomala*.

*Psenopsis anomala*.

*Trachynotus anomalus*, Schleg. Faun. Japon., Poiss. p. 107, pl. lvii. fig. 2 (1850).

*Psenes anomalus*, Blkr. Verh. Bat. Gen. xxvi. 1853, p. 104.

*Psenopsis anomalus*, Gill, l. c.

*Parapsettus anomalus*, Steind. Ann. Hofmus. Wien, xi. 1896, p. 211.

Depth of body  $2\frac{1}{4}$  times in total length, length of head  $3\frac{3}{4}$  times. Snout as long as the eye, the diameter of which is  $4\frac{1}{2}$  times in the length of head, interorbital width  $2\frac{2}{3}$  times. Maxillary extending to vertical from anterior margin of eye. Præ-, sub-, and interopercles with minute denticulations. D. V-VI, 29-30, the anterior spines very short and feeble, the last 2 or 3 graduating to the higher soft rays, the soft fin emarginate, the anterior rays twice as high as the last. A. III 26, similar to soft dorsal. Pectorals falciform, as long as the head. Ventrals short, inserted below the pectorals. Caudal moderately forked. Scales very deciduous, about 50 in a longitudinal series. Lateral line following dorsal profile at about  $\frac{5}{7}$  the height of the body. Dark gleaming purple above, silvery below.

Total length 190 millim.

Japanese Seas.

*Psenopsis cyanea*.

*Bathyseriola cyanea*, Alcock, Ann. & Mag. Nat. Hist. (6) vi. 1890, p. 202, and Cat. Indian Deep-sea Fishes, p. 43, and Ill. Zool. 'Investigator,' pl. xviii. fig. 1.

Depth of body  $3\frac{1}{4}$  times in total length, length of head 3 times. Snout a little longer than the eye, the diameter of which is nearly 5 times in the length of head and  $1\frac{2}{3}$  times in the interorbital width. Maxillary extending to below middle of eye. Præ-, sub-, and interopercles with minute denticulations. D. VIII-IX 24-25, the first 4 or 5 spines short and feeble, the last 2 or 3 graduating to the higher soft rays. A. III 22. The anterior rays of soft dorsal and anal the highest. Pectorals pointed, about  $\frac{3}{4}$  the length of head. Ventrals much shorter, inserted in front of the pectorals. Caudal forked. Scales very deciduous, apparently about 60 in a longitudinal series. Lateral line following dorsal profile at about  $\frac{4}{5}$  the height of the body. Uniform gleaming bluish black.

Total length 135 millim.

Off Ganjam coast, 98-102 fathoms, and off Godavari coast, 240-276 fathoms.

[To be continued.]